Battery Charging
Float vs. Cycling

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FEMP

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Lead-Acid Batteries

- Still the best way to store electricity
- Flooded = Vented = Need Watering
- Valve-Regulated = Sealed = No Watering

(*Not* No Maintenance)

Refer to:
ALPHABET SOUP:
BATTERIES and CODES

Curtis Ashton
Qwest Local Network

Float vs. Cycling Environments

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Float Systems

- Relatively Rare Discharges
- Load Usually Well Understood
- Charge Procedure Well Defined
- Constant, High-Quality Charge Voltage

Cycling Systems

- Continuous Charge/Discharge Operations
- Frequently Deep Discharged
- Rarely Floated (or equalized properly)

Cycling Systems

Operating Environment

- Load Not Always Predictable
- Frequently Deep Discharged
- Not Always Fully Recharged

Charging Strategies

- Use Typical Float Charge Profile
- Use Time (Not Energy) to Determine State-of-Charge (SOC)
- Frequently Not Equalized Properly

Intermediate (Deficit) State of Charge

Charge = Ampere-hours

To maintain battery capacity:

Charge in = Charge out

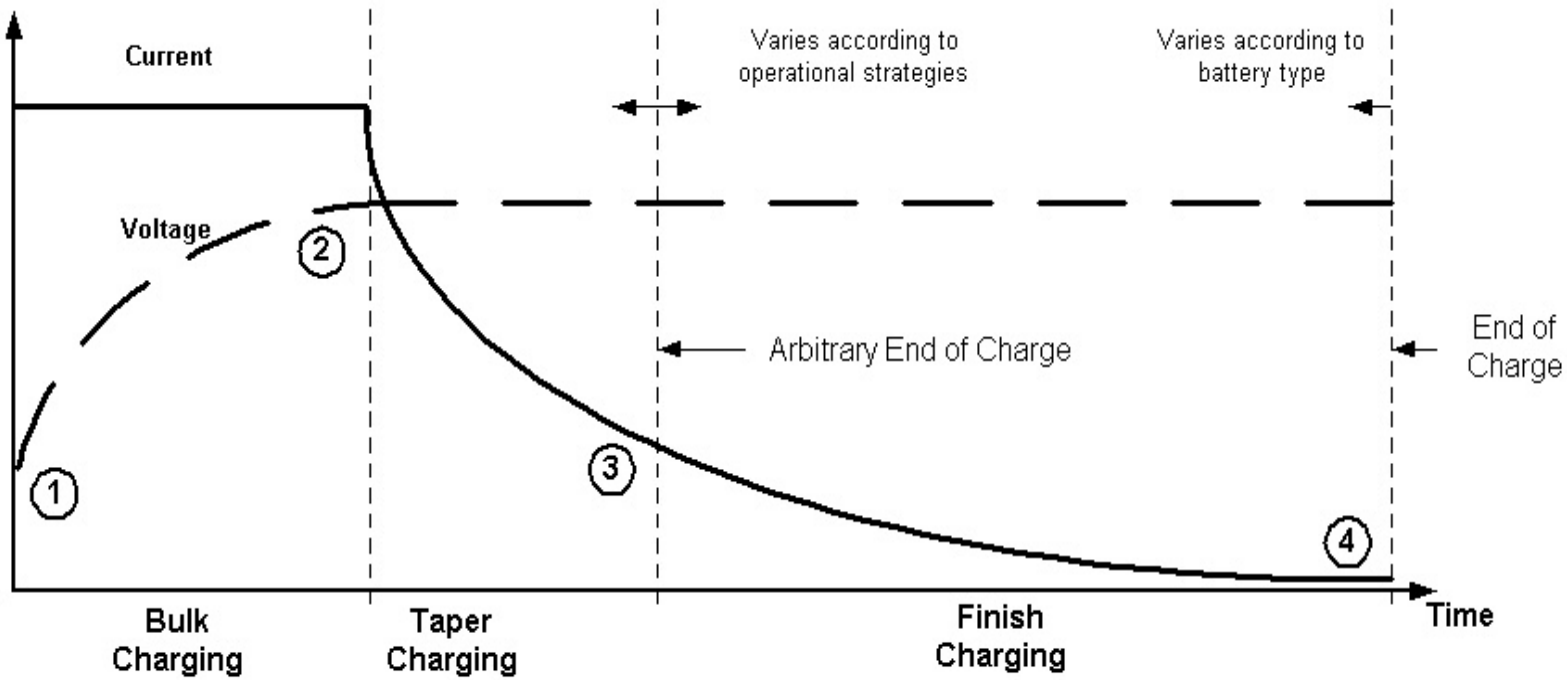
+ fudge factor (10% or so)

Otherwise

Battery is in deficit state of charge

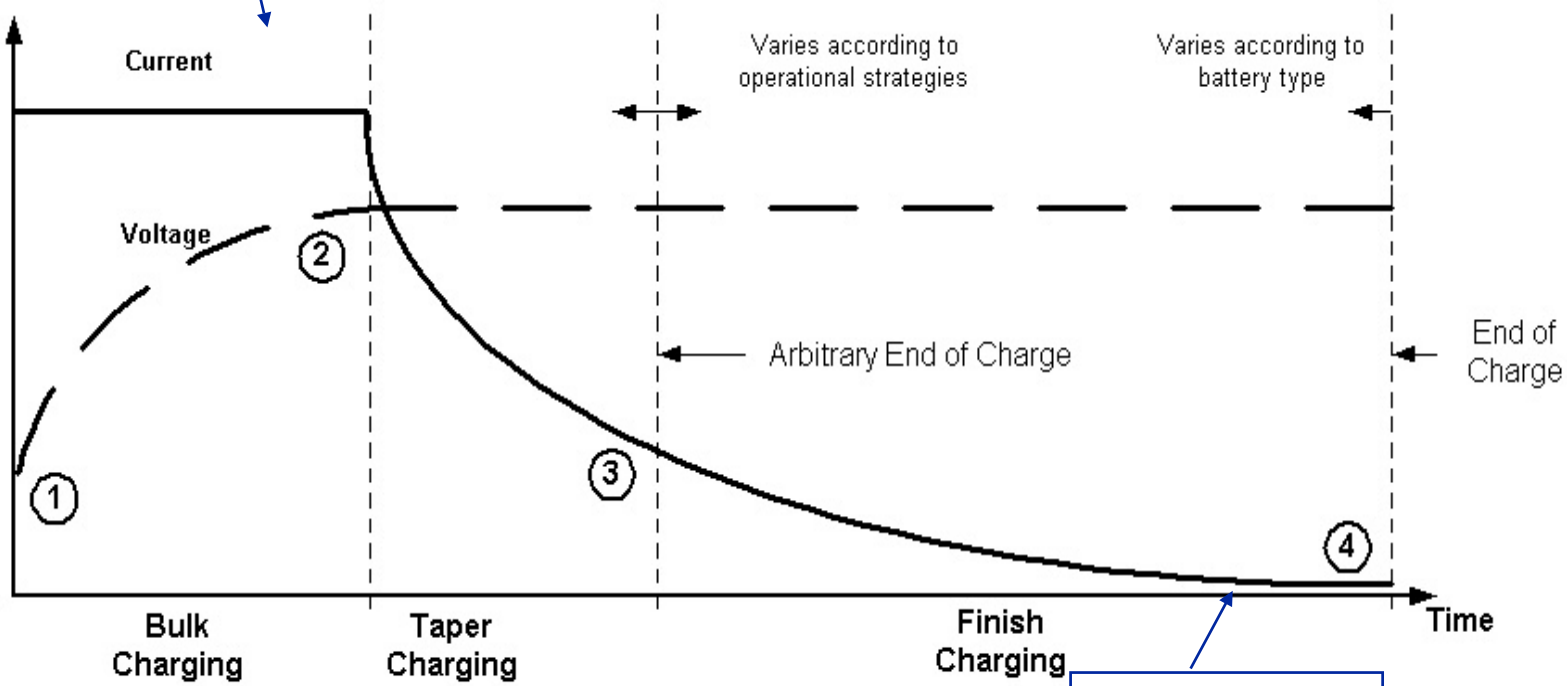
And *lifetime is shortened*

Typical Charge Profile



Battery Viewpoint

Good charge acceptance



Poor charge acceptance

Lots of electrolysis

Necessary to fully recharge

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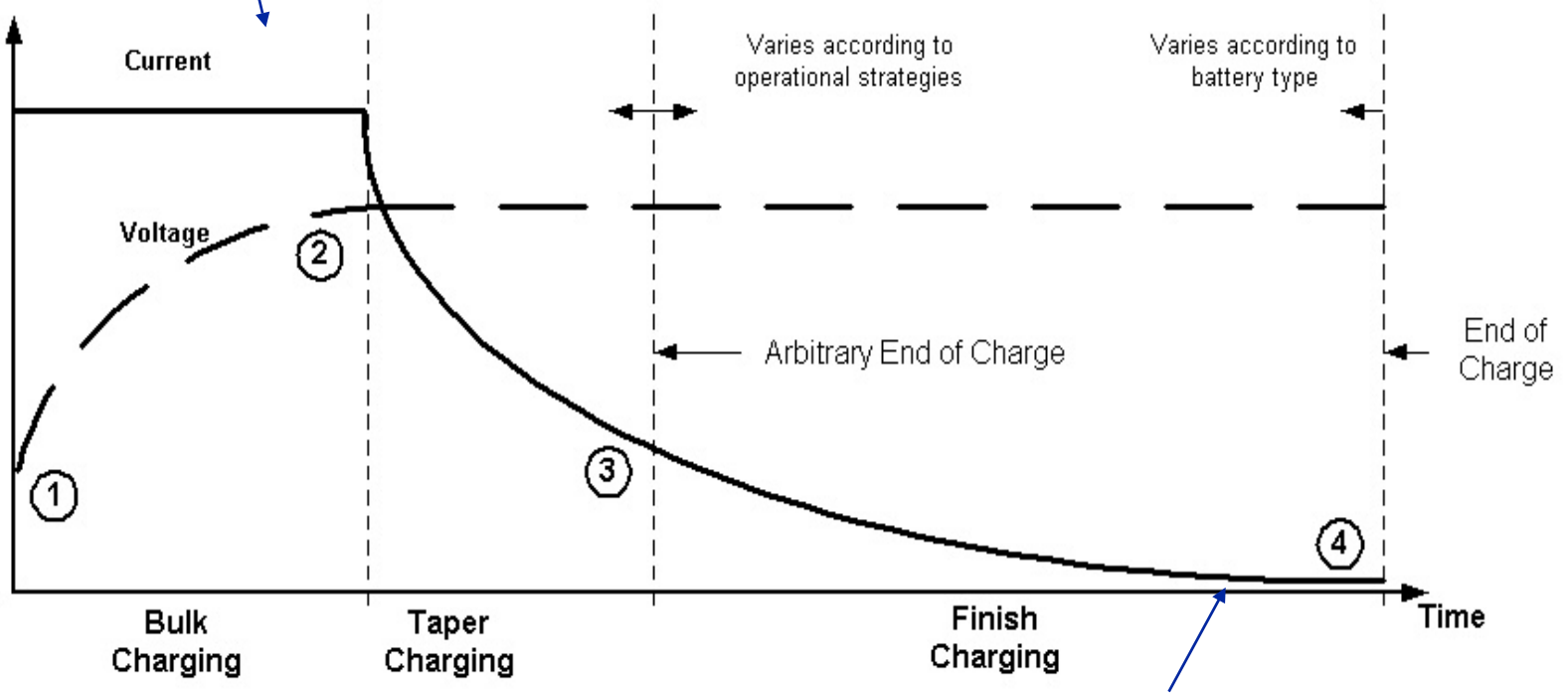
Engine Viewpoint

High power = best engine efficiency



Low power = poor engine efficiency

If batteries not fully recharged periodically, they will surely die!

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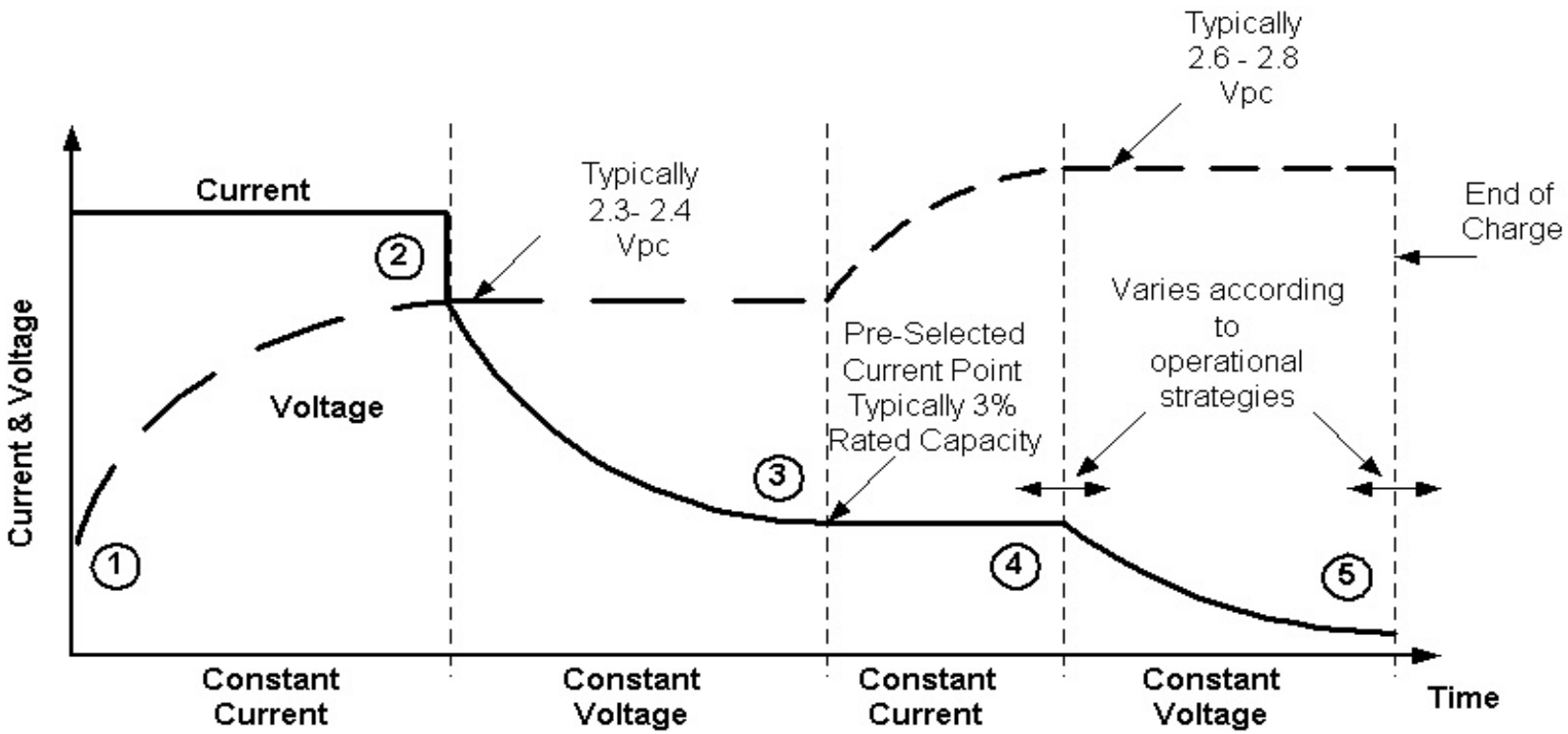
Fully Charge Periodically!



A Cycling Operating Environment

Real World Approach

- Focus on “System” Efficiency
- Operate in Best Battery Efficiency Regime
- Operate the Way Users Want to Cycle

The Intermediate SOC Operations

- Never Operate Below 50% SOC
- Periodic Charging to 100% SOC

Battery Charging Guidelines PV-Generator Hybrid

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Table 1
Vented

Variable	Minimum (Hybrid) Lead-Antimony	Maximum/Equalize Lead-Antimony
PV Regulation Voltage (Vr) @ 25°C	14.4/2.40 vpc to 15.0/2.5 vpc Constant Voltage 13.5-14.7/2.28-2.45 vpc to 13.7-15.0/2.28-2.50 On-Off	15.3/2.55 vpc Constant Voltage 13.7-15.3/2.28-2.55 vpc On-Off
Engine Generator Vr @ 25°C	14.4/2.40 vpc to 15.3/2.55 vpc	15.3/2.55 vpc
Engine Generator Time @ Vr	0 to 3 hr. – (Bulk Charge, 3-day max interval if PV doesn't charge battery to regulation voltage)	5 to 12 hr. – (15-day max interval with daily cycles)
Low Voltage Disconnect (LVD)	1.95 vpc (11.7 volts)	2.0 vpc (12.0 volts)
Temperature Coefficient V/°C/cell	-0.005	-0.005

Table 2
VRLA

Variable	Minimum (Hybrid) VRLA	Maximum/Equalize VRLA
PV Regulation Voltage (Vr) @ 25°C (Use Manufacturers Specs)	14.1/2.35 vpc or 14.4/2.40 vpc Constant Voltage 13.5-14.2/2.28-2.37 vpc On-Off or 13.7-14.5/2.28-2.42 On-Off	14.1/2.35 vpc or 14.4/2.40 vpc Constant Voltage
Engine Generator Vr @ 25°C (Use Manufacturers Specs)	14.1/2.35 vpc or 14.4/2.40 vpc Constant Voltage	14.1/2.35 vpc or 14.4/2.40 vpc Constant Voltage
Engine Generator Time @ Vr	0 to 6 hr. – (Bulk Charge, 15-day max interval with daily cycles)	12 hr. – 15-day Max Interval with daily cycles
Low Voltage Disconnect (LVD)	1.95 vpc (11.7 volts)	2.0 vpc (12.0 volts)
Temperature Coefficient V/°C/cell (Use Manufacturers Specs)	-0.005	-0.005

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From BOS Brief #5 – General Guidelines Only

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Conclusions

- Charging requirements different for cycling applications
- Consult battery manufacturer and other references before installing $$$ battery